Claims:

1. A catalyst composition represented by the formula:

$$\alpha_a\beta_b\gamma_gMX_n$$

wherein M is a metal;
X is a halogenated aryloxy group;
β and γ are groups that each comprise at least one Group 14 to Group 16 atom;
α is a linking moiety that forms a chemical bond to each of β and γ; and
a, b, g, and n are each integers from 1 to 4.

2. The catalyst composition of claim 1, wherein X is a perfluorophenoxy group.

3. The catalyst composition of claim 1, wherein the catalyst composition is supported on a carrier.

4. The catalyst composition of claim 1, further comprising an activator.

5. The catalyst composition of claim 1, wherein M is selected from the group consisting of titanium, zirconium, and hafnium.

6. The catalyst composition of claim 1, further comprising one or more metallocene catalysts represented by the formula:

$$Cp^ACp^BMX_n$$

wherein:

M is a metal atom;

Cp^A and Cp^B are each independently an unsubstituted or substituted cyclic ring group;

X is a leaving group; and

n is zero or an integer from 1 to 4.

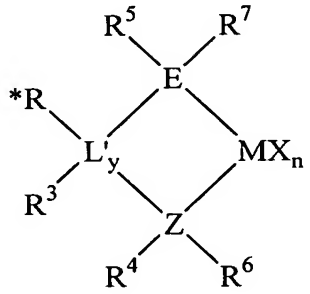
7. The catalyst composition of claim 6, wherein Cp^A and Cp^B are each independently selected from the group consisting of cyclopentadienyl, indenyl, combinations thereof, and derivatives thereof.

8. The catalyst composition of claim 6, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group.

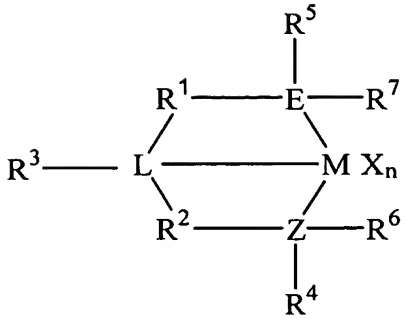
9. The catalyst composition of claim 6, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group and the one or more polymerization catalysts comprises a bridging group A, bridging Cp^A and Cp^B.

10. The catalyst composition of claim 6, wherein Cp^A is a cyclopentadienyl group and Cp^B is a cyclopentadienyl group.

11. A Group 15 containing metal catalyst compound represented by one of the following formulas:



or



wherein M is a metal;

X is a halogenated aryloxy group;

y is 0 or 1;

L is a Group 15 element;

L' is a Group 15 element;

E is a Group 15 element;

Z is a Group 15 element;

R^1 and R^2 are independently a C_1 to C_{20} hydrocarbon group, a heteroatom containing group having up to twenty carbon atoms, silicon, germanium, tin, lead, or phosphorous;

R^3 is a hydrocarbon group, hydrogen, halogen, or heteroatom containing group;

R^4 and R^5 are independently an alkyl group, aryl group, substituted aryl group, cyclic alkyl group, substituted cyclic alkyl group, cyclic arylalkyl group, substituted cyclic srylalkyl group or multiple ring system;

R^6 and R^7 are independently an alkyl group, hydrogen, halogen, heteroatom, or hydrocarbyl group; and

R^* is a Group 14 atom containing group, hydrogen, halogen, or heteroatom containing group.

12. The catalyst compound of claim 11, wherein X is a perfluorophenoxy group.

13. The catalyst compound of claim 11, wherein the catalyst compound is supported on a carrier.

14. The catalyst compound of claim 11, further comprising an activator.

15. The catalyst compound of claim 11, wherein M is selected from the group consisting of titanium, zirconium, and hafnium.

16. The catalyst compound of claim 11, further comprising one or more metallocene catalysts represented by the formula:

$$Cp^ACp^BMX_n$$

wherein:

M is a metal atom;

Cp^A and Cp^B are each independently an unsubstituted or substituted cyclic ring group;

X is a leaving group; and

n is zero or an integer from 1 to 4.

17. The catalyst compound of claim 16, wherein Cp^A and Cp^B are each independently selected from the group consisting of cyclopentadienyl, indenyl, combinations thereof, and derivatives thereof.

18. The catalyst compound of claim 16, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group.

19. The catalyst compound of claim 16, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group and the one or more polymerization catalysts comprises a bridging group A, bridging Cp^A and Cp^B.

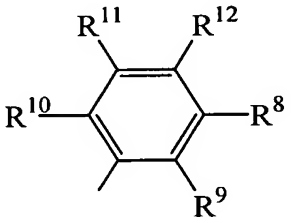
20. The catalyst compound of claim 16, wherein Cp^A is a cyclopentadienyl group and Cp^B is a cyclopentadienyl group.

21. The method of claim 11, wherein the halogenated aryloxy group comprises a perfluorophenoxy group.

22. The method of claim 11, wherein R^1 and R^2 are selected from the group consisting of a C_1 to C_{20} hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, and phosphorus.

23. The method of claim 11, wherein the L or L' is bonded to a hydrogen, a Group 14 atom containing group, a halogen, or a heteroatom containing group, and wherein each of the two Group 15 atoms are bonded to a cyclic group, hydrogen, a halogen, a heteroatom, a hydrocarbyl group, or a heteroatom containing group.

24. The method of claim 11, wherein R^4 and R^5 are represented by the formula:

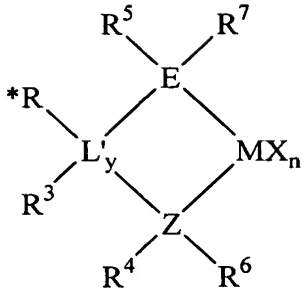


wherein R^8 to R^{12} are each independently hydrogen, a C_1 to C_{40} alkyl group, a halide, a heteroatom, or a heteroatom containing group containing up to 40 carbon atoms.

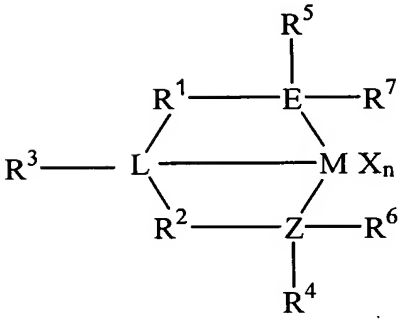
25. A method for olefin polymerization comprising combining one or more olefins with a catalyst system represented by the formula:

$$\alpha_a\beta_b\gamma_gMX_n$$

or



or



wherein M is a metal;

X is a halogenated aryloxy group;

β and γ are groups that each comprise at least one Group 14 to Group 16 atom;

α is a linking moiety that forms a chemical bond to each of β and γ;

a, b, g, and n are each integers from 1 to 4;

y is 0 or 1;

L is a Group 15 element;

L' is a Group 15 element;

E is a Group 15 element;

Z is a Group 15 element;

R^1 and R^2 are independently a C_1 to C_{20} hydrocarbon group, a heteroatom containing group having up to twenty carbon atoms, silicon, germanium, tin, lead, or phosphorous;

R^3 is a hydrocarbon group, hydrogen, halogen, or heteroatom containing group;

R^4 and R^5 are independently an alkyl group, aryl group, substituted aryl group, cyclic alkyl group, substituted cyclic alkyl group, cyclic arylalkyl group, substituted cyclic srylalkyl group or multiple ring system;

R^6 and R^7 are independently an alkyl group, hydrogen, halogen, heteroatom, or hydrocarbyl group; and

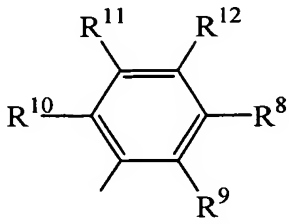
R^* is a Group 14 atom containing group, hydrogen, halogen, or heteroatom containing group.

26. The method of claim 25, wherein the halogenated aryloxy group comprises a perfluorophenoxy group.

27. The method of claim 25, wherein R^1 and R^2 are selected from the group consisting of a C_1 to C_{20} hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, and phosphorus.

28. The method of claim 25, wherein the L or L' is bonded to a hydrogen, a Group 14 atom containing group, a halogen, or a heteroatom containing group, and wherein each of the two Group 15 atoms are bonded to a cyclic group, hydrogen, a halogen, a heteroatom, a hydrocarbyl group, or a heteroatom containing group.

29. The method of claim 25, wherein R^4 and R^5 are represented by the formula:



wherein R^8 to R^{12} are each independently hydrogen, a C_1 to C_{40} alkyl group, a halide, a heteroatom, or a heteroatom containing group containing up to 40 carbon atoms.

30. The method of claim 25, wherein the catalyst system is supported on a carrier.

31. The method of claim 25, wherein the olefin polymerization takes place within a continuous gas phase reactor or a continuous slurry phase reactor.

32. The method of claim 25, wherein the one or more olefins comprises ethylene, propylene, or a combination thereof.

33. The method of claim 25, wherein the catalyst system further comprises an activator.

34. The method of claim 25, wherein M is selected from the group consisting of titanium, zirconium, and hafnium.

35. The method of claim 25, further comprising combining the one or more olefins with one or more metallocene catalysts represented by the formula:

$$Cp^ACp^BMX_n$$

wherein:

M is a metal atom;

Cp^A and Cp^B are each independently an unsubstituted or substituted cyclic ring group;

X is a leaving group; and

n is zero or an integer from 1 to 4.

36. The method of claim 35, wherein Cp^A and Cp^B are each independently selected from the group consisting of cyclopentadienyl, indenyl, combinations thereof, and derivatives thereof.

37. The method of claim 35, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group.

38. The catalyst compound of claim 35, wherein Cp^A is a cyclopentadienyl group and Cp^B is an indenyl group and the one or more polymerization catalysts comprises a bridging group A, bridging Cp^A and Cp^B.

39. The catalyst compound of claim 35, wherein Cp^A is a cyclopentadienyl group and Cp^B is a cyclopentadienyl group.

40. A method for synthesizing a pentafluorophenoxy containing catalyst composition, comprising:

adding a catalyst composition represented by the formula:

$$\alpha_a\beta_b\gamma_gMX_n$$

wherein M is a metal;

X is a halogenated aryloxy group;

β and γ are groups that each comprise at least one Group 14 to Group 16 atom;

α is a linking moiety that forms a chemical bond to each of β and γ; and

a, b, g, and n are each integers from 1 to 4; and

adding a sufficient amount of a trimethylsilyl derivative comprising at least one pentafluorophenoxy group to form a metal complex comprising the at least one pentafluorophenoxy group.

41. The method of claim 40, further comprising supporting the metal complex on a carrier.

42. The method of claim 40, wherein M is selected from the group consisting of titanium, zirconium, and hafnium.

43. The method of claim 40, wherein X is perfluorophenoxy group.